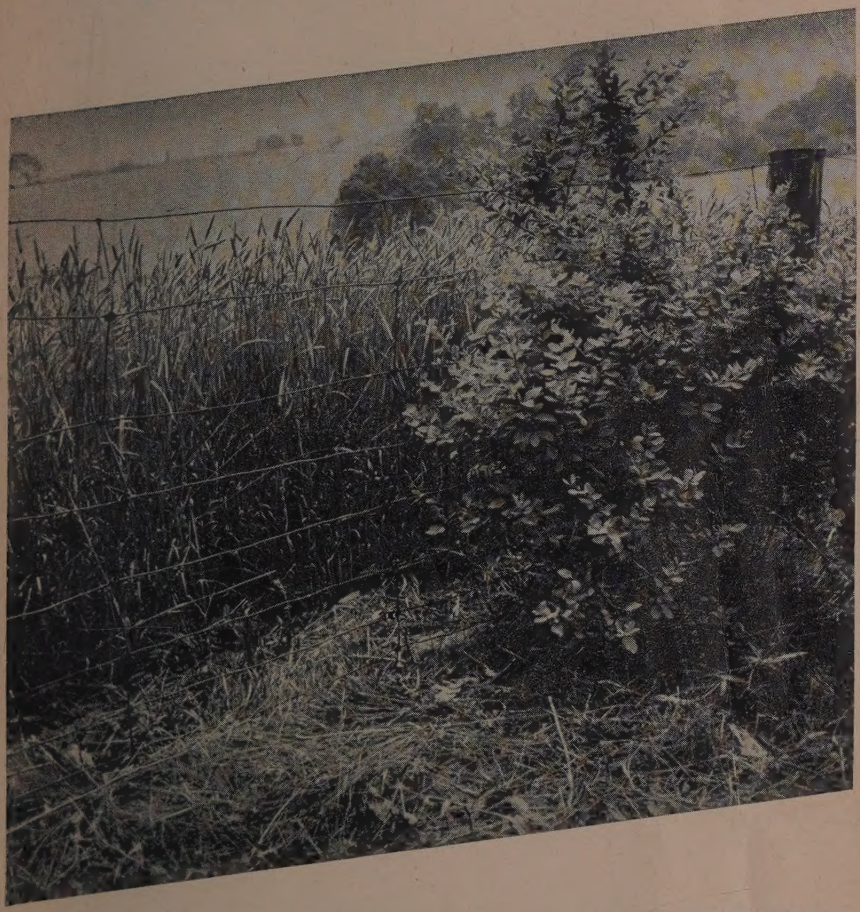
KILL BARBERRY BUSHES that spread STEM RUST to grains



FARMERS' BULLETIN
No. 2014

U. S. DEPARTMENT OF AGRICULTURE

Does stem rust of wheat, oats, barley, and rye reduce your income?

Stem rust is caused by a fungus which develops on barberry bushes. This destructive disease can be controlled by killing rust-spreading barberry bushes and planting rust-resistant varieties of grains. This bulletin tells how to recognize rust-spreading barberry bushes and how to kill them.

Federal, State, and local agencies and individuals are cooperating in a barberry-eradication project to control stem rust.

Report locations of rust-spreading barberries to your county agent or State department of agriculture.

Washington, D. C. Issued April 1950

KILL BARBERRY BUSHES THAT SPREAD STEM RUST TO GRAINS

Prepared in the Division of Plant Disease Control, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration

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STEM rust is a disease of small grains caused by a tiny fungus. This disease can cause disastrous losses in grain crops. It reduces the yield and quality of wheat, oats, barley, and rye. It can completely ruin a farmer's crop. Damage from stem rust occurs in some localities every year, and it has caused losses up to 200 million bushels of grain in a single season.

The fungus develops in the spring on rust-susceptible barberry bushes in the northern half of the United States. It spreads from barberries to certain grains and grasses. Spores of the fungus, which float in the air, can be carried long distances by wind. Enough spores can be produced on one barberry bush to infect 70 billion grain plants. The disease cannot start in the spring in the northern grain-growing States, unless barberry bushes are present on which the fungus can grow, or unless spores are blown in from long distances.

How Stem Rust Can Be Controlled

The destructive stem rust disease can be controlled by killing all rust-spreading barberry bushes and planting only rust-resistant varieties of grain. Your county agent can tell you the grain varieties best suited to your locality.

How to Recognize the Harmful Barberries

There are many kinds of barberry bushes. Only three are of major importance in spreading stem rust in the United States. You should

learn to recognize the rust-spreading barberries that grow in your locality.

The European barberry is the most important of the rust-spreading bushes. It was brought here by colonists. As the frontier moved westward, early settlers took this shrub with them to plant in their yards. It escaped from cultivation and now grows wild the same as any of our hardy native plants. This barberry is scattered over most of the northern grain-growing areas. It grows in yards, wood lots, and pastures, along fence rows and stream banks, and in other uncultivated places.

The European barberry is easily recognized. It is an erect bush commonly six or more feet high when mature. The outer bark of the stems is gray, the inner bark yellow, and the edges of the dark green leaves are saw-toothed. Usually there are three spines under each group of leaves. Red berries hang in bunches as currants do in the fall (fig. 1).

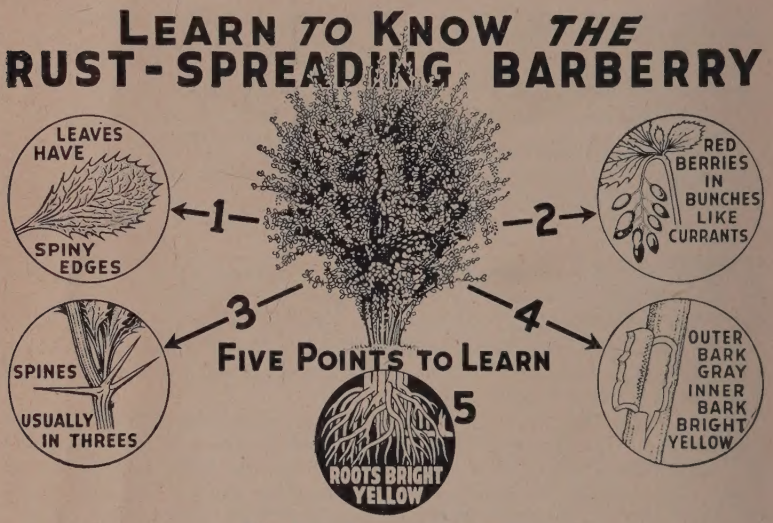

Figure 1.—European barberry.

Two kinds of native barberries also spread stem rust. One of them, the Allegany barberry, grows in Virginia and West Virginia. The other, the Colorado barberry, grows in southwestern Colorado. These native wild plants are similar to the European barberry but are low shrubs that grow in clumps, or patches (fig. 2).

Report the location of rust-spreading barberry bushes to your county agent or State department of agriculture.

Not all barberries are harmful. The Japanese barberry is commonly grown as an ornamental bush. It does not spread rust and should not be destroyed. Leaves of the Japanese barberry and its horticultural varieties are small with smooth edges. The outer bark of the stems is reddish brown and the inner bark is bright yellow. Spines are usually single, and bright red oval berries are produced

singly or in groups of two or three. The sale of these harmless barberries is regulated by State and Federal quarantines.

If you have a barberry bush and you are not sure it is harmless, ask your county agent.

How to Kill Barberries

Kill all rust-spreading barberry bushes. Do not dig barberry bushes. They have long, deep root systems. Any roots left in the ground may produce new bushes. The best way to kill them is to use a chemical in the manner recommended below.

Put Common Salt on Them

You can kill all barberry bushes by putting common salt about the crowns. It is a simple and easy means of killing large bushes growing

Figure 2.—Native barberry.

in places where salt will not harm valuable plants. Apply about 20 pounds for each square foot of crown area to kill the European barberry (fig. 3).

Sprinkle salt lightly on the ground around the canes of the native barberries to kill them.

Apply Ammonium Sulfamate to the Stubs

Ammonium sulfamate is a good chemical to use in killing widely scattered bushes of the European barberry. Cut off the canes close to the ground and apply the chemical in dry form to all the freshly cut surfaces. The amount that can be placed on the stubs after the canes

have been cut is enough to kill the bush (fig. 4). A pound will kill several medium-size bushes. Do not use this chemical where there is a chance that it might injure valuable plants nearby.

Treat the Stubs With 2,4–D

The weed killer 2,4–D kills both native and European barberry bushes. Apply it at full strength with a paint brush to the freshly cut

Figure 3.—Applying salt to crown of barberry bush.

stubs of European barberry canes (fig. 5). Treat every cane. This is the best way to kill barberry bushes growing close to other valuable plants.

Native barberry bushes are killed with 2,4–D used as a foliage spray. Wet the leaves, stems, and crowns thoroughly with the spray. Do not use these sprays near valuable plants.

Figure 4.—Ammonium sulfamate applied to cut stubs of barberry canes.

Figure 5.—Applying 2,4–D to freshly cut stubs of barberry canes.

Caution

The chemicals used for killing barberries are not poisonous to man or animals in the dosages used. However, the precautions commonly observed in handling and applying chemicals should be taken.

How the Stem Rust Lives

The stem rust fungus (fig. 6) survives the winter in the black-spore stage on grain stubble, straw, and certain grasses. These over-wintering spores germinate about the time barberry leaves come out in the spring. They produce tiny, colorless spores that infect only leaves of rust-spreading barberry bushes. After a short period of growth, the fungus produces another type of spore in cuplike growths on the under side of the barberry leaves.

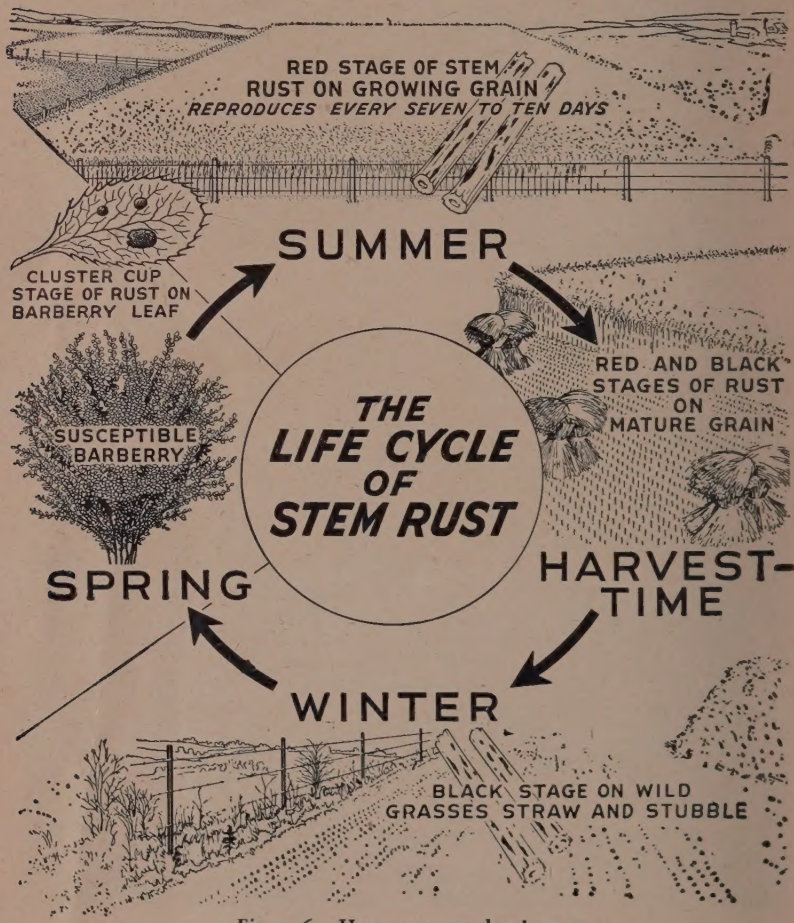
RED STAGE OF STEM RUST ON GROWING GRAIN
REPRODUCES EVERY SEVEN TO TEN DAYS
SUMMER
CLUSTER CUP STAGE OF RUST ON BARBERRY LEAF
RED AND BLACK STAGES OF RUST ON MATURE GRAIN
SUSCEPTIBLE BARBERRY
THE LIFE CYCLE OF STEM RUST
SPRING
HARVEST-TIME
WINTER
BLACK STAGE ON WILD GRASSES STRAW AND STUBBLE

Figure 6.—How stem rust develops.

These spores are shot out of the cups into the air and scattered by the wind. When they fall on grain plants or certain kinds of grasses they germinate and grow into the stems (fig. 7). As the fungus grows, it takes its food and moisture from the host plants. Within 10 days rust spots filled with thousands of red spores are produced on the grain stems.

These red spores are scattered by the wind. They can start new infections only on susceptible grain and grass plants. In the red stage the fungus continues to grow, multiply, and spread from plant to plant and from field to field, until harvesttime. As the grain matures, the fungus prepares for winter. Black, thick-walled spores, capable of

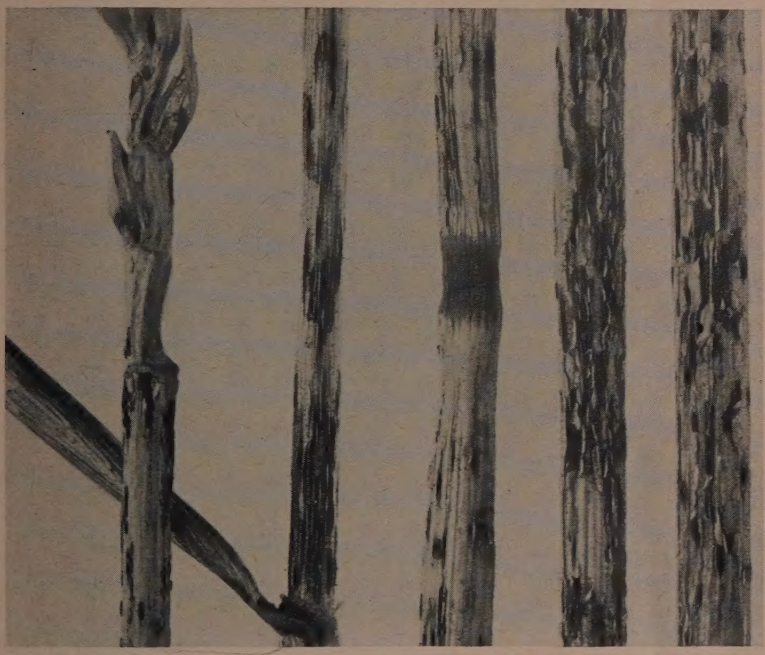

Figure 7.—Stems of grain plants infected with stem rust.

surviving the northern winter weather, develop on the grain and grass plants. They live there until the following spring.

How Stem Rust Affects Different Varieties of Grain

There are several varieties of stem rust. One variety attacks wheat, another oats, and still another rye. Varieties of stem rust that attack wheat and rye also attack barley. Many different races of stem rust attack wheat, oats, and rye. Each race can attack only certain varieties of these small-grain crops. The races differ in the way they can attack the different varieties of grain. Scientists know more than 200 different races of stem rust that attack wheat, 13 that attack oats, and 14 that attack rye. Present races can cross-breed on the barberry to

produce new races. A new race that can attack varieties of grain now considered resistant to the disease may be produced occasionally.

There are many more races in areas where barberries are numerous than in localities free of these bushes. As many as 25 races of the fungus have been found on grains and grasses within 25 feet of a single barberry bush. Some that are not found elsewhere are often found in barberry-infested places.

The existence of so many races complicates the work of the plant breeders in the development of rust-resistant varieties of small grain. Resistant grain varieties today may not be resistant tomorrow. A new race produced on the barberry may become established and cause severe damage to newly developed resistant varieties of grain. This has happened to certain supposedly rust-resistant varieties in the past, and they are no longer widely grown. With fewer races of stem rust being produced, plant breeders have a better chance to develop rust-resistant grain varieties. Likewise, the many high-quality, high-yielding selections already in use will get better protection against stem rust.

How Stem Rust Overwinters in the South

Stem rust spores are carried by the wind from the northern grain-producing States to southern Texas and to Mexico. This movement takes place in the fall of some years, when there is abundant rust and the wind blows from north to south. They infect the new crop of winter wheat in the South, where the rust lives through the mild winter. Here the fungus multiplies in the spring, producing billions of red spores which may be carried northward by the wind. They fall on northern grain fields, and under favorable conditions infect the plants. The rust continues to multiply and spreads throughout the Mississippi Valley. General and severe rust damage from this source occurs only occasionally, however, when weather conditions, volume of rust spores, and growth stage of grains are all favorable at the same time. The interchange of rust spores between the North and the South makes barberry eradication of Nation-wide importance. Races of rust produced on barberry in the North can be carried south by wind. There they multiply and spread in all directions to endanger crops throughout the country.

How Stem Rust Affects Farmers

Stem rust causes enormous losses of grain. It lowers the test weight and reduces the quality of the grain. Such grain is heavily discounted on the market. Grain production was completely abandoned at one time in some barberry-infested areas in the Grain Belt.

Destructiveness of stem rust is obvious where barberry bushes occur in grain-growing areas. In Pennsylvania, near Davidsburg, rust developed on barberry bushes early in 1946. This initial infection spread from field to field and from one community to another, until an area of more than 400 square miles had been covered by the epidemic. More than 200,000 bushels of wheat had been destroyed by harvesttime. Farm income in this small community was reduced more than $300,000.

In southeastern Washington nearly a quarter of a million bushels of wheat were lost because of stem rust in 1943. This epidemic spread directly from thousands of barberry bushes growing adjacent to fields of wheat.

More than 1,500 such spreads of stem rust from barberry bushes to grains and grasses have been reported since barberry eradication started. Hundreds more have been observed. Local and regional epidemics break out less frequently now, as more and more rust-spreading barberry bushes are removed from the important grain-producing areas. Farmers are again growing small grain on land where the production of such crops was once abandoned because stem rust ruined them.

How the Stem Rust Control Program Stands Today

More than a third of a billion barberry bushes have been destroyed in the 18 States (fig. 8) participating with the Bureau of Entomology and Plant Quarantine in this program. About four-fifths of this huge control area is now considered practically free of barberry

Figure 8.—States participating in the cooperative barberry-eradication program.

bushes. Only limited work is required to keep the cleared territory in this condition.

Rust-spreading barberries are still abundant (fig. 9) on favorable sites within areas totaling about 200,000 square miles. Most of these sites will require repeated inspections over a period of years to complete the eradication job. Some of the infested areas are in rough wooded territory, where finding and killing barberry bushes will be difficult. Under such conditions progress is slow and the cost and amount of necessary rework are large.

How Barberry Eradication Benefits Farmers and the National Economy

Farmers in Virginia reported a 68-percent increase in wheat yields after barberry bushes had been removed from their farms (fig. 10). Oat farmers in northeastern Pennsylvania increased their yields of

Figure 9.—Barberry bushes that grew from seed after original plants had been killed.

Figure 10.—Wheat from rust-infected plants (*A*), and rust-free plants (*B*).

this crop by 123 percent after barberry bushes in their communities had been destroyed. Similar reports are heard repeatedly as local areas are cleared of barberries.

Stem rust losses in the 18 participating States averaged more than 40 million bushels annually in early years of barberry eradication. Farmers' losses in these States averaged about $44,000,000 each year. Now, since large areas have been cleared of rust-spreading bushes and resistant grain varieties are grown on large acreages, losses have been reduced to a yearly average of about 14.7 million bushels with a farm value of $14,500,000, as shown in figure 11.

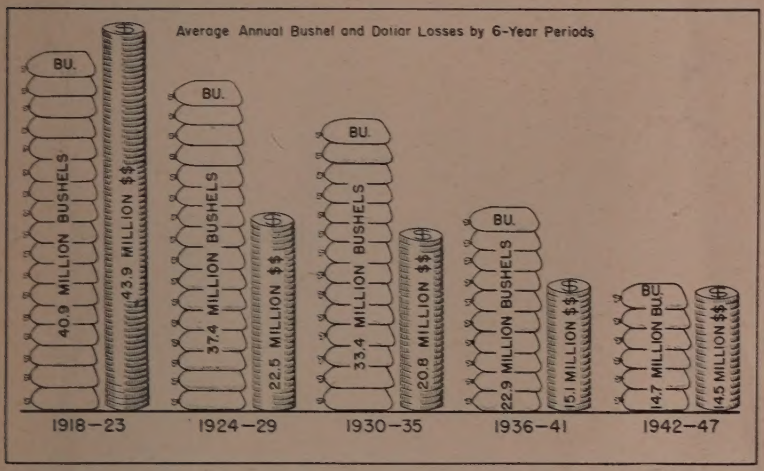

Figure 11.—Stem rust losses of wheat, oats, barley, and rye decrease as control work progresses.

Barberry eradication thus far has cost less than 1 cent an acre each year for wheat, oats, barley, and rye harvested in the 18 States participating in this work.

Our daily bread and the prosperity of thousands of farmers depend upon a stable production of small grains. Whole industrial empires are based on grain and its manufacture into countless products. Grain losses caused by stem rust can disrupt these industries and reduce our food supply. Eradication of the rust-spreading barberry helps control this destructive disease and protects the food economy of the Nation.

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